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DISTRIBUTION OF POTENTIAL ABOUT HIGH VOLTAGE LINE INSULATORS.
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REPORT OF N. E. L. A. ELECTRIC RANGE COMMITTEE.

FAULTS OF NATIONAL ELECTRIC SAFETY CODE.
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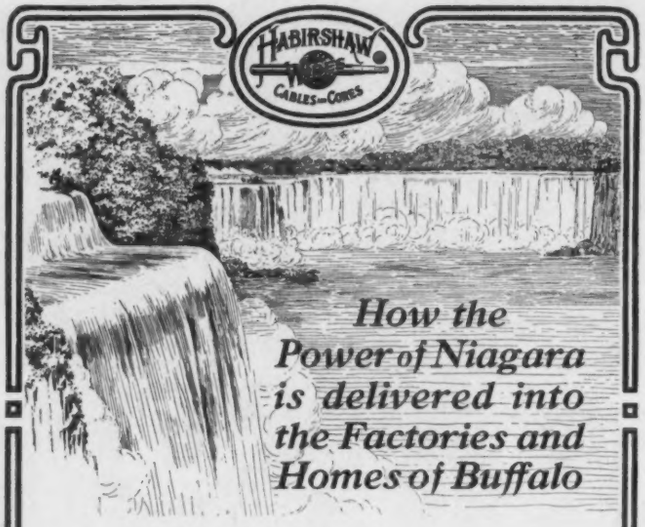

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PROSPECTIVE MARKET FOR IRRIGATION PUMPING

BY JOSEPH JACOBS.

(While this report refers specifically to the Celilo power development at The Dalles, Oregon, as a power source, its conclusions apply to many irrigation projects throughout the West. The report constitutes Appendix L of the Report on the Columbia River Power Project, which is being printed in full in these columns. The author is consulting engineer with the U. S. Reclamation Service.—The Editor.)

Purpose and scope of investigation. The reason for undertaking the investigation herein dealt with was to ascertain to what extent irrigation pumping might demand electric power from the proposed power development at Celilo Falls on the Columbia River. Its primary purposes, in other words, was to determine the extent of this power demand and not to make any critical examination of the irrigation projects themselves, though it was, of course, necessary that these projects be examined sufficiently to reasonably establish their feasibility or the reverse. To this end all the projects named as feasible in this report, and many others which were finally rejected as infeasible or as not economically dependent on Celilo power, were examined on the ground, and while no definite surveys were made, their essential physical elements were determined as fully as this could be done by field inspection, aided by the best maps available and by the use of ordinary hand instruments such as the aneroid barometer and the hand level. I was assisted in this work by D. S. Hays, who was continually in the field during the months of May, June and July.

The Three Sisters in the Cascade Mountains, which Range Deprives Eastern Oregon and Washington of Rainfall, thus making Irrigation Necessary.

So far only as the immediate field work is concerned, the territorial scope of this investigation was confined to the arid and semi-arid districts along the valley of the Columbia River and its primary tributaries in Oregon and Washington, exclusive however of central Oregon and of that portion of Washington lying north of the main line of the Great Northern Railway. The writer's familiarity with the districts last named, as a result of field examinations made by himself during the past few years, relieved the necessity for their detailed field inspection at this time, and especially so in view of every indication that, to the

extent that opportunities offer for irrigation pumping in these districts, these can be more economically served from sources of power other than that herein contemplated.

Having in mind the element of time and the fact that the end sought in this inquiry is a quantitative expression of the probable irrigation power demand on the proposed Celilo development, it is necessary that this report confine itself rather rigidly to a discussion of those features which tend directly toward that end, including, of course, brief descriptions of most of the irrigation projects involved.

Topographic situation. The dominant topographic feature, and that of first significance for the region under consideration, is that the Columbia River, which constitutes at once the main water supply and the drainage of the region, flows between high bluffs and on low gradients for the greater part of its length within the states of Washington and Oregon and until it emerges from the Cascades just east of Portland. This canyon-like feature even more markedly characterizes the Snake River from its confluence with the Columbia at Pasco to the eastern boundary of Washington, at Clarkston. There are but restricted areas of bottom land along these rivers, but upon the slopes of their confining walls and particularly upon the adjacent bench or plateau, at heights varying from 100 ft. to 600 ft. above the river, are excellent bodies of fertile land requiring only the application of water to render them productive. The gradients of these rivers are so flat, ranging from 1 ft. to 3 ft. per mile, and the main bodies of irrigable land are so high above the rivers as to render gravity canals from that source entirely impracticable. Gravity water supplies from other sources are also, with few exceptions, unavailable to these lands because such supplies are either now fully appropriated and utilized or they are economically more applicable to other lands. Pumping from these great rivers therefore remains the only practicable means of redemption of these areas from permanent aridity.

Sources of water supply. As stated in the previous paragraph, the chief source of water supply for the projects herein considered must forever be the Columbia River. Consideration was given to other streams, as the Snake and Yakima Rivers, and to ground waters, but these sources are in nowise comparable to the Columbia. The fact is, that so little is known of ground water supplies in Oregon and Washington that but little reliance can be placed upon them as fertile fields for power demand on the Celilo development. This is true not only because of our limited knowledge concerning the location of such supplies, but also, so far as they are known, because of their generally restricted yield and of their distance from the proposed source of power. There are of course possibilities of pumpage from shallow wells far greater no doubt than we are now aware of, but however valuable these may prove to be in the general scheme of agricultural expansion their aggregate power consumption will be so small in comparison with the larger pumping projects as to have but little present bearing upon the feasibility of the proposed Celilo development. Some of these shallow well pumpage possibilities will be referred to further on in this report.

Irrigation by means of deep well pumps in this district is as yet comparatively new, and in its experimental stage. A few such plants have been installed, as for instance on the Horse Heaven plateau and in the Quincy Valley district in central Washington, but neither economic operation nor an abundant water supply has yet been proven for either of these districts. Both of these implied causes will, in my opinion, operate to prevent any important power demand from that source. Other ground water possibilities for pumping are from springs and artesian supplies, but these too are destined not to create a great power demand—primarily because of their scarcity, but also because they may usually be applied to the land without recourse to pumpage.

Feasibility of projects. The projects herein considered must be studied not only with respect to their inherent feasibility as individual pumpage developments, but more particularly with respect to their relation to the proposed Celilo development from which source it is intended they shall derive their power. Even though a highly attractive pumping project may be evolved on the basis of using Celilo power, such a project should be excluded from final consideration if there is assurance of cheaper power being supplied from some other source. In other words, due weight must be given to the element of competition with other power, whether electric or of other form, and also to that of competition with gravity water supplies, where such alternatives offer.

Feasibility with respect to time will depend upon the rapidity with which cheaper gravity projects are developed and successfully colonized, and in considering this feature we must contemplate this entire Northwest territory and to a certain extent the entire Pacific Coast. Unquestionably, the establishment of trade routes through the Panama Canal will induce a rapid increase of immigration to this coast. This in turn will induce a keen demand for agricultural lands and will compel the early development of many irrigation projects, but until the better gravity schemes have been absorbed, whether these happen to be in Idaho, in Oregon or in California, it will be difficult to successfully colonize the higher priced pumpage lands.

There will of course be an immediate demand for those lower lift pumpage schemes which are economically comparable with the better class gravity schemes, but the higher lift schemes must in my opinion await the consummation above indicated, and moreover their success and feasibility depend also upon the careful working out of a scheme of finance that provides for long deferred final payments and easy terms to those who purchase and settle upon the land. Failure to take cognizance of these factors would result in overestimating the real irrigation demand that is likely to be put upon Celilo power, and to that extent would be misleading.

Pumpage and gravity schemes compared. Gravity irrigation is generally more economical, and heretofore has been more reliable than pumpage irrigation, as a result of which pumpage irrigation has been resorted

Typical View of Snake River Canyon Between Oregon and Idaho.

to only when gravity supplies were not available. This is evidenced in the records of the last national census, which shows that the total irrigated area of the United States in 1909, was 13,738,485 acres, of which but 477,623 acres, or 3.5 per cent, was served by pumping schemes. The record also shows that this acreage was served by 15,803 individual plants, pumping against an average lift of 37 ft. and requiring 361,480 horsepower of power plant capacity for their operation, of which about one-third was applied to rice land irrigation in the southern states and two-thirds to general western irrigation. It is seen then that irrigation pumping has not yet assumed large proportions in the United States and that thus far it has generally been confined to small developments and low lifts. Examples of comparatively high lift schemes, however, are not wanting, and unquestionably we are now entering upon an era of larger projects and higher lifts for pumping schemes.

Snake River Near Coon Hollow Damsite.

One of the usual chief advantages of a pumping plant is the immediate proximity of the pumping plant to the land, thus at once eliminating the feature of a main supply canal with its considerable seepage and evaporation losses and the initial cost and continuing maintenance of which constitute an important element in the economics of gravity schemes. Considering the best modern pumping machinery in comparison with the operation of long main canals, the matter of reliability of service may largely be eliminated and the final selection of the alternative of gravity or pumpage scheme must rest on the criterion of annual cost. Annual power cost is the chief disadvantage of a pumping project, and the price of power must indeed be low to render the ordinary pumping plant as economical as the ordinary gravity plant. With few exceptions, the alternative of gravity or pumpage supply is not offered with respect to the projects herein considered, and unless a feasible scheme of pumping (and that means cheap power) can be developed the major part the lands will forever remain waste and arid.

Present power costs. The more common form of contract for supplying electric power for irrigation pumping in the Columbia River Valley provides for the payment of a fixed charge of $12 per annum per h.p. of connected load, plus a rate varying with the amount of power used from $3 to $5 per month per h.p. of maximum demand, which for rated capacities up to 5 h.p. must equal the connected load, and for rated capacities over 5 h.p. must be not less than 75 per cent of the connected load. Some contracts also provide, in lieu of a flat rate per h.p. per month, a graduated meter rate which varies from .5 cents to 3 cents per kw.-hr., the three-cent rate applying to the first 30 kw.-hr. per rated kilowatt ofconnected apparatus and the one-half cent rate applying to all power in excess of 420 kw.-hr. per rated kilowatt of connected apparatus. Still another contract provides for the payment of a fixed charge of $3 per month per kilowatt-ampere of connected apparatus plus .5 cent per kw.-hr. of power consumed, with minimum charge of $12 per kilowatt-ampere per annum.

These various rates, as applied to different connected loads up to 1000 h.p. and on the assumption of six months of continuous pumping at rated capacity, equate to a kw.-hr. rate of from 0.93 cents to 1.37 cents per kw.-hr. of actual power consumption. In

Salmon River.

practically no irrigation pumping projects however are the units so arranged as to permit of the conditions such as to require continuous pumping at rated capacity of the machinery installed, and the actual final cost of power on a straight kw.-hr. basis would therefore be in excess of the figures above named. This is particularly true of small individual plants where the actual pumping time may be as little as one-half or one-third of the total irrigation season, a large head of water being thus provided which permits a rapid irrigation of the land. Such an arrangement is often desirable, not only because the land may require that character of treatment, but also because the water user may prefer thus to conserve his own time even though it involve an increase in cost of power.

I have been able also to secure the rates as well as the actual cost of power for a number of the larger irrigation pumping projects along the Columbia River and, on the basis of actual power consumed during the irrigation season, I find these rates to have varied from 0.855 cents per kw.-hr. to 1.53 cents per kw.-hr. On the whole I think it conservative to say that present power rates for irrigation pumping will approximate 1 cent per kw.-hr. of actual power consumed for the larger plants, and 1½ cents per kw.-hr. of actual power consumed for the smaller plants, i. e., for plants of less than 25 h.p. capacity.

The validity of the Oregon water code has been upheld by the U. S. Supreme Court in the case of the Pacific Livestock Company versus the Oregon Water Company. The Livestock Company had alleged that the code deprived it of its property in violation of the fourteenth amendment of the constitution.

The postal savings act has been amended so that interest will be paid deposits up to $1000 instead of only $500, as has heretofore been the case. The $100 limit for deposits in any calendar month has also been removed.

REPORT OF N. E. L. A. ELECTRIC RANGE COMMITTEE.

(Continued.)

Some Suggestions Regarding Range Construction.

Many practical and useful suggestions have been gathered from those who have had experience in the electric range business and the more important of these suggestions are given hereunder. It is likely that their consideration may be of advantage to manufacturers and central stations alike.

Electric ranges should be built as nearly as possible to conform to types of gas ranges now in use. As electric ranges are necessarily more expensive, the additional investment required to make them much more substantial than the average gas range is something which is of little consequence. The small additional investment would add very considerably to the life of the range and consequently the average yearly cost to the customer would be lessened and thus more nearly meet the cost of the gas range.

The more ranges there are in use, the more desirable becomes the installation of the pilot lamp. Only the most careless cook or servant would leave any switch closed when the circuit is not in use, if a lamp or other indicating device were there at the level of the eye to remind her of the fact.

Rotary snap switches controlling the service to various heaters should have a distinctive feature either in color or position of indicator or both, when current is off. The distinctive feature at the present time on most of these switches is the reading of the word "off" but in a dim light or when the eye sight is not of the best, reading is not always easy. A distinctive color for the lettering of the word "off" or the uniform or distinctive position for the indicator will quickly convey the idea to the operator whether or not the circuit is disconnected, even if only a hasty glance is given. Complaints regarding the size of bills are generally caused not by the use of energy but by its abuse or waste.

Twin Falls of Snake River.

For general designs and capacities of ranges the following suggestions are valuable, presuming only three types of ranges are selected:

1 Three discs and low oven similar to the Westinghouse 2-18.
2 Three discs and high oven similar to the General Electric S-2.
3 Four discs, side oven and warming oven, similar to the Hughes No. 50 and Hotpoint D.

The features essential in any standard range are:

(a) Reliable heating elements that may be easily, quickly and cheaply renewed.
(b) Easily cleaned oven, with substantial tight-fitting drop door.
(c) Dependable oven thermometer.
(d) Some provision for broiling.
(e) Substantial and durable construction of the range frame.
(f) Attractive finish (plenty of white enamel and nickel finish).
(g) Non-rust ovens.
(h) Terminal contacts to be installed so that troubles from this source may be as far as possible eliminated. There is much room for improvement in this direction.
(i) Separate fuse plugs on ranges.
(j) Cooker pots are desirable.
(k) Crumb trays have distinct advantages.
(l) One or two plug outlets on the range for attaching a percolator, toaster or other small appliance; these outlets should be separately fused.
(m) Ovens should not be less in size than 12 by 16½ by 18. They should be well insulated, even in the cheaper ranges.

Burners and Utensils.

The question as to types of burners and the proper kinds of utensils to use with the different types of burners is one concerning which there has been much discussion and a great deal of testing, and, in some respects, the testing and discussions have not reached conclusions which are entirely satisfactory.

There are two distinct types of electric heating elements or burners— disc and open coil. Of the open coil, there are two kinds—coils placed in grooves in moulded blocks and coils supported by a steel frame and insulated by means of mica or porcelain. One manufacturer is making removable reflectors to be placed underneath the open coil and it is claimed that this combination will considerably increase the economy by concentrating the heat rays upon the cooking utensil.

The representatives of two manufacturers, one using enclosed units and the other open coil units, state that their burner will now average 5000 hours of actual use. In other words, the average life of their units in use in the home will be approximately seven years. Further, it requires the enclosed type of burner to operate the cooker pots and this feature on the electric range is economical and has some distinct advantages.

It cannot be denied that the open coil type of unit appeals to the housewife because she can see the glowing coils. When she snaps the switch of this type of unit, there is a quick response and the heat is immediately apparent.

Regarding the most desirable utensils to use with the different types of burners, one of the advantages of the open coil unit is that the average utensil, in the average used condition, such as is found in the average home, will give the highest economy. In other words, a dish with a dull surface will absorb the radiant heat rays from the open coil unit to the best possible advantage.

With the disc or enclosed type of burner, it is apparent that the utensils should be smooth, flat and have a thoroughly cleaned surface so as to make a good contact and obtain the best possible efficiency.

Apparently it has been definitely decided that the disc or enclosed type of burner will give better results if aluminum utensils are used and that, with the open coil type of burner, the enamel ware utensils seem to give the most satisfaction. The ordinary utensils used on a gas stove can be used on an electric range whether open coil or enclosed type. As the open coil burner more nearly resembles the gas burner, it naturally follows that the ordinary kitchen utensils used on the gas stoves are more likely to operate with greater efficiency on the open coil burner than on enclosed or disc type burners.

Advantages of Electric Cooking.

When a consumer is approached by a salesman with the idea of creating an interest in electric cooking and the installation of an electric range, one of the first questions asked is "How does it compare in cost," with the fuel which the customer may then be using for cooking purposes. The question of comparative cost is one which should be carefully handled and we do not propose to deal with it here. However, there are so many advantages in connection with the use of electricity for cooking purposes over any and all other kinds of fuel that the question of comparative cost is not of such great importance as it would seem at first glance. Lighting by means of gas has always been considered much cheaper than by means of electricity, but today almost everyone demands electric lighting if it can be obtained, regardless of the expense as compared with other illuminants. The reason of this condition is that electric lighting has advantages all its own. We feel that electric cooking also has advantages all its own, which tend to minimize comparisons regarding relative cost of operation. For the benefit of salesmen and other central station employes the following list of advantages of cooking by electricity has been compiled. It is not claimed that the list is a complete one.

1. **Safe.**—The elimination of matches and the fact that there is no flame which means absolute protection from the hazard of fire. No danger of explosions.

2. **Clean.**—No blackened walls, dirt, soot or smoke. Also electric ranges are easy to clean and easy to keep clean because no dirt is caused by fuel

3. **Sanitary.**—No poisonous gases to escape and contaminate the atmosphere and the food which is kept in the kitchen or pantry. If a plant or flower is kept in a room where gas is used, it will soon wither. The air which is not good for plant life is not good for human beings.

4. **Regulation.**—The electric stove has perfect regulation. A quarter turn of the switch starts the fire at maximum heat, another quarter turn of the switch gives medium heat, another quarter turn gives low heat. It can be controlled in such a way that there is an even temperature at all times for the many different kinds of food to be cooked.

5. **Certainty.** The absence of uncertainty as to results to be obtained. A poor cook will cook food better on an electric range and a good cook will do her best with electricity.

6. **Economy.**—Economy in food value otherwise wasted by shrinkage and additional nutriment retained in all food cooked; there being no flame, there is no extraction of juices that should remain in the food, these juices being as a rule the best portion and most vital parts of the food.

7. **Cool.**—Concentration of heat where it is needed; no unnecessary heat in kitchen. The electric stove is especially desirable in warm summer months, there being no radiation of heat in the room.

8. **Bright.**—Bright utensils, no dirty, smoky pots or pans to be constantly cleaned.

9. **Perfect.**—The perfection of baking is done by means of the electric oven, all guess work as to temperature being eliminated. The perfection of broiling is the electric broiler, no fumes or gases to contaminate the food which is cooking so close to the heat and no smoke from spattering grease catching fire from a flame.

10. **Saving.**—Saving in shrinkage in food means saving of money. Time is saved in cleaning up the range and cleaning the utensils. Health is saved due to better nutrition of electrically cooked foods and the living and working in a better atmosphere.

11. **Controlled.**—Cooking becomes an exact science. No uncertainty and no failure, the cooking being controlled by regulators and not by guess.

12. **Appetizing.**—Meals are more savory, more digestible and altogether better.

13. **Efficient.**—Efficient and quick in operation. Heat is instantly available and readily regulated.

14. **Conserved heat.**—Oven retains baking temperature long after current is turned off.

15. **Dainty.**—Kitchen clothes no longer a necessity because kitchen duties become light and the work clean.

16. **Progressive.**—Adds dignity to housework and keeps in step with the march of progress.

[To be continued.]

Commission regulation of municipal utilities is presaged in an argument filed with the Railroad Commission of California by the Pacific Light & Power Corporation in its controversy with the City of Pasadent. Pasadena owns an electric lighting plant and is serving electricity in South Pasadena, a separate municipality. The Pacfiic Light & Power also serves S. Pasadena and has appealed to the state to regulate and obtain a certificate of public convenience and necessity. The question is of wide interest in California, owing to the fact that a number of cities own public utility plants which are serving consumers outside of the city limits. The commission, in view of the general interest excited by this case, has invited any city attorney or public utility corporation attorney in the state, who desires to be heard, to file a brief in this case. If the commission decides that the City of Pasadena is to be classed with private corporations engaged in public utility service when the city undertakes to sell its power or light to consumers outside its limits, then it will be compelled to make its outside rates conform to a standard which the commission deems just in a regulated field.

DISTRIBUTION OF POTENTIAL ABOUT HIGH VOLTAGE LINE INSULATORS.

BY CHESTER T. ALCUTT AND W. K. SKOLFIELD.

(This is an abstract of a thesis prepared by the authors while students in the electrical engineering department of Leland Stanford Jr. University. The abstract was prepared by Professor Harris J. Ryan and includes results communicated by him to the San Francisco Section of the A. I. E. E. at the February meeting.—The Editor.)

Use is made of the exact similarity that exists between the distribution of current in a conducting medium and the electrostatic flux in a non-conducting medium when the form and arrangements of the electrodes are the same throughout. The distribution of potentials that are caused by the current and flux are also similar.

Thus a high voltage line insulator, conductor, pin and the air in which they are immersed may be replaced by a model made up of materials having conductivities that are related to one another, quantitatively, precisely as are the specific inductive capacities of the corresponding real things. In this model, alternating current may be set up from the "pin" through the "insulator" and "air" to the conductor.

As is well known, the potential surfaces thus established in the "air" about the "insulator" may then be located by means of a probing electrode connected through a telephone receiver from a potentiometer that bridges the supply leads and from which any desired fraction of the voltage applied to the "insulator" may be tapped. To locate a potential surface the probe is moved through the "air" about the "insulator" along the corresponding line of silence as located with aid of the telephone receiver.

Expediency requires that a conducting fluid be used for the "air" in the model and that the "insulator" be made of some material that can be readily formed and that can be conductively altered as required. The "pin" and "conductor" in the model must be of high conductivity metal. Such models are easily constructed in all those cases where the insulator proper and its adjacent conductors constitute a solid of revolution. A fairly exact example of this sort is a suspension-strain insulator. A closely approximate example is an ordinary pin-type insulator supporting a transverse conductor; it would be more exact if the conductor were mounted axially with respect to the insulator and pin. In these cases the model needs to be made only of a sector of the original which is much less expensive to make than for the complete insulator. Most of the cases that arise in practice are almost exactly or approximately of the solids of revolution sort for which models of corresponding sectors only have to be made. The insulators studied were those for which models of sectors only were required.

The construction of a model of a sector of an insulator, pin and conductor is shown in Fig. 1. The procedure in making such a model is as follows: About equal parts, by volume, of lampblack and plaster of paris are thoroughly mixed. Water is then added and the mixture is stirred until it becomes a thick paste. This paste is moulded into a 10 to 15 degree wedge. The model of the sector of the insulator is then cut out with a sharp knife, carefully following the edges of a templet prepared in advance. This operation should

be carried on rapidly as it is difficult to cut the composition after it has set. The templet should be constructed of paraffined carboard. If it is allowed to adhere to the composition, the model will be greatly strengthened and there will be less danger of breakage in subsequent handling. If desired, the model may be made in parts corresponding to the shells of the actual insulator, using conducting strips in place of the cement. As the cement between the shells is a decidedly poor conductor it is probable that little is to be gained by using a multipart model of a corresponding multiparted insulator.

After the model has hardened it is placed in a rectangular glass-bottomed tray with its axis parallel to one of the sides. The tray is constructed with a sheet of cross-section paper under the glass to facilitate the location of points on the paths of silence traced by the probe. The "pin," "tie-wire" and "line conductor"

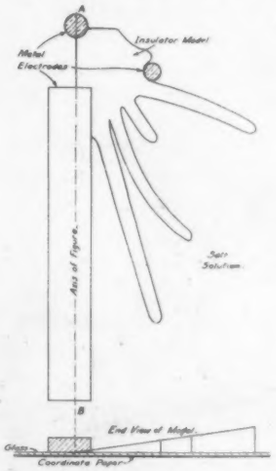

Fig. 1. Model of Insulator in Tray for Testing.

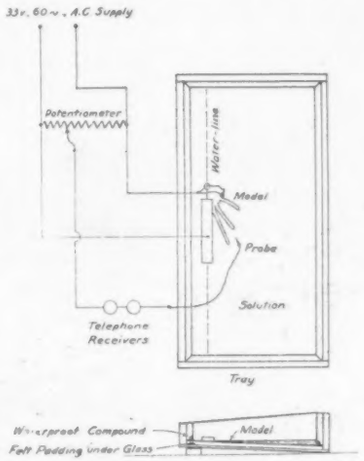

Fig. 2 Diagram of Tray and Electrical Connections

are of metal and are placed as shown in Figs 2, 3a and 3b. To represent the ground in the case of the suspension insulator, a metal plate is mounted in the tray perpendicularly to the axis of the insulator and at the proper distance below it. Such plate is connected to one side of the current source. The model and the metal parts are fastened to the bottom of the trap by means of sealing wax. Suitable connections are made to the pin, line-conductor and tie-wire. Then the tray is tilted until the top surface of the model is horizontal and a salt solution is poured in until it stands level with the top of the model. See Figs. 2 and 3a.

The most satisfactory way to obtain a solution of the proper conductivity is as follows: Out of each batch of plaster of paris-lampblack mixture a flat, rectangular slab about one-quarter of an inch thick is made. This slab is placed in a tray with suitable electrodes as shown in Fig. 4. The electrodes are long rectangular metal bars and are placed parallel so that the distance between them is equal to twice the width of slab. Then the tray is filled with water up to the level of the top surface of the slab. As water dissolves a small amount of plaster of paris (calcium sulphate) it must be saturated with such plaster prior to the use herein so as to prevent any dissolution of the slab and consequent change in the conductivity of the liquid. An alternating electromotive force is applied between the electrodes and salt is added to the water until the drop in potential across the slab is about one-sixth of the total. This gives a conductivity ratio of 5 to 1, corresponding to a specific inductive capacity of 5 for the dielectric in the insulator. The potentiometer method used in measuring the drop is made clear in the diagram.

Fig. 3. a. Locating Lines of Silence.

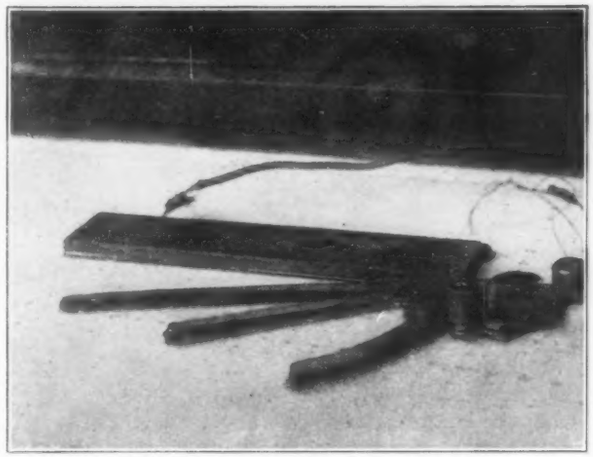

Fig. 3. b. Insulation Model on Plotting Board.

With a little experience it is possible so to proportion the plaster of paris and lampblack mixture that the saturated solution of the plaster will have nearly the correct conductivity without the addition

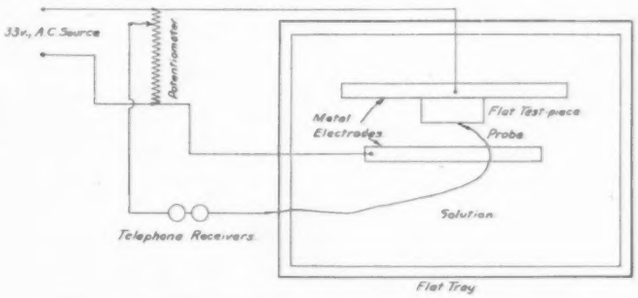

Fig. 4. Arrangement for Solution Conductivity Test.

of salt. The conductivity ratio may vary from 4.5 to 5.5 in., 5.0 is the correct ratio without effecting material distribution about the model.

The electrical connections used in tracing the equipotential surfaces are shown in Fig. 2. A source of alternating current is connected to the electrodes

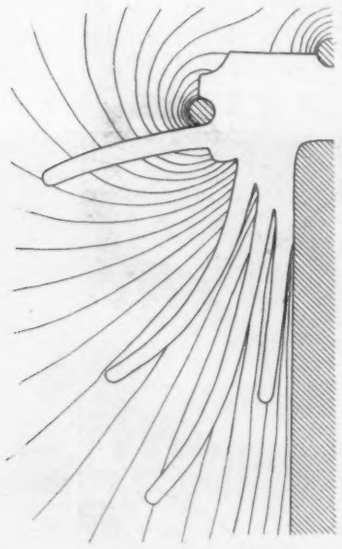

Fig. 5.

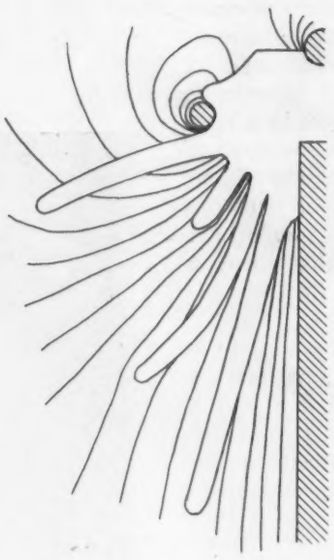

Fig. 6. Dry.

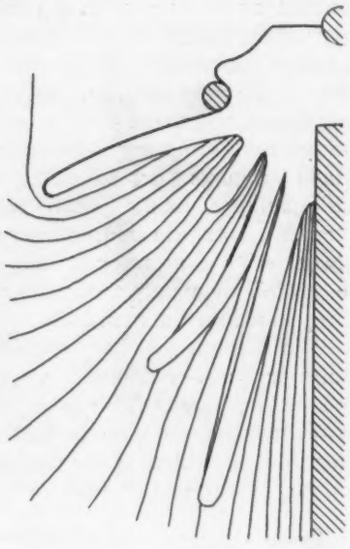

Fig. 7 Top Surface Conductive.

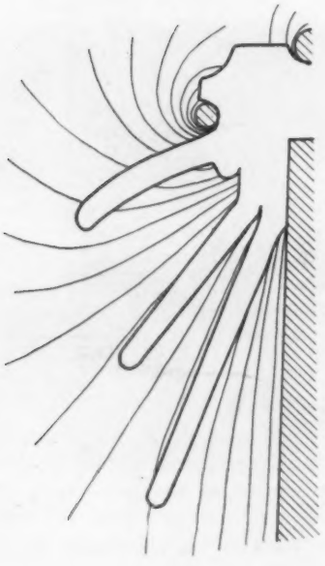

Fig. 8.

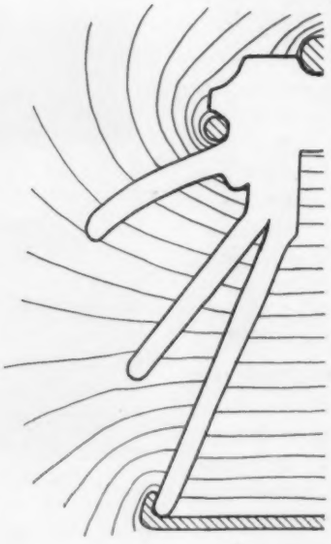

Fig. 9.

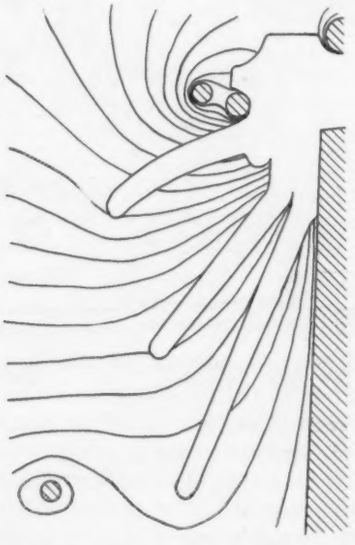

Fig. 10. Showing Effect of Arcing Rings.

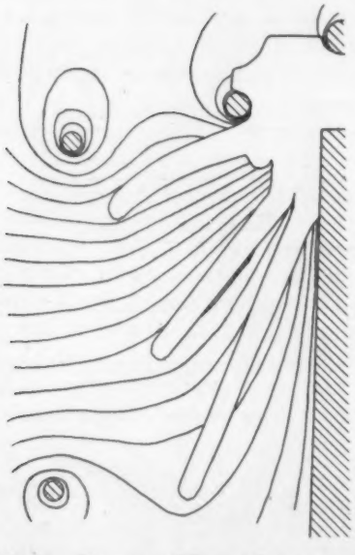

Fig. 11. Showing Effect of Arcing Rings.

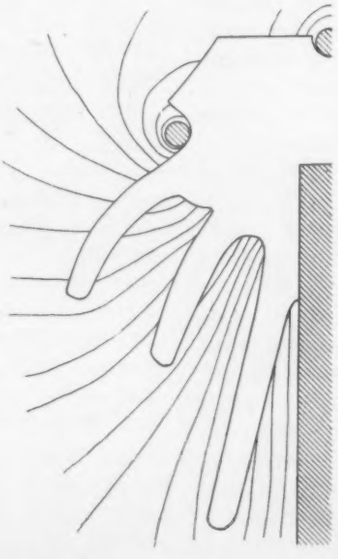

Fig. 13.

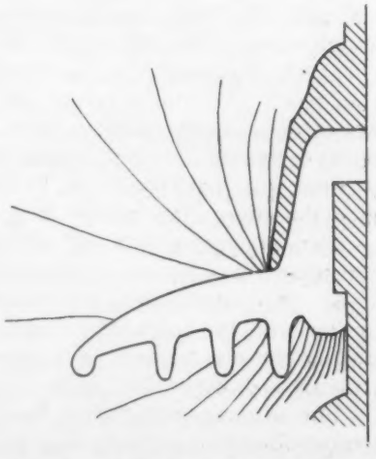

Fig. 14. Single Suspension Unit

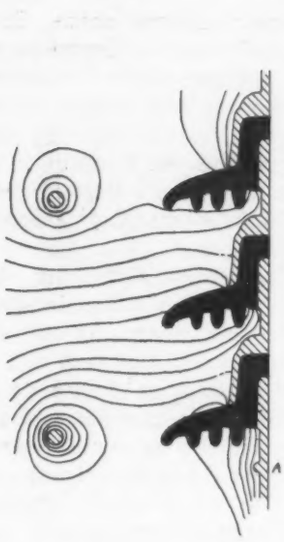

Fig. 15 Three-Unit String, Bottom Pin at Ground Potential; Ground 2 string-lengths below A.

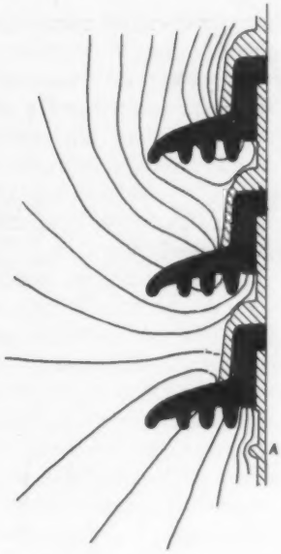

Fig. 16. Three-Unit String with Arcing Rings; Ground 2 string-lengths below A.

representing the pin and line conductor. The probe point consists of a short piece of enamelled wire, the tip of which is bare. The probe is connected through a pair of telephone receivers to the potentiometer, as shown in the diagram. By means of the potentiometer it is possible to divide the voltage across the insulator model into any number of equal intervals. In locating the equipotential surface corresponding to one of the voltage intervals, the probe tip is moved around in the bottom of the tray until a point is found whereat there is no sound in the telephone receivers. The position of the point is read off on the cross-section paper in the bottom of the tray. It is then platted on a similar piece of cross-section paper upon which is a drawing of the insulator section in the same relative position with regard to the coordinate axes as the model in the tray. A sufficient number of points on each equipotential surface are determined and plotted to enable the line locating such surface to be drawn in.

The writers had at their disposal only a sixty-cycle source of current. A higher frequency would have enhanced audibility in the telephone receivers and would have been far preferable. When the work is done in a quiet room the 60 cycle current makes enough sound to locate the null point accurately.

Most engineers visualize the conditions existing in an electrostatic field by a consideration of the flux lines rather than the potential zones. The tubes of flux are everywhere at right angles to the zones of potential, and may, therefore, be sketched in if desired. Since the lines that locate the potential zones mark the voltage duties that are carried by the surfaces of an insulator and by the atmosphere adjacent thereto, it is of corresponding importance to become familiar with the character of such lines. Broken lines locating the electrostatic flux tubes about a link-type insulator are drawn in Fig. 17.

The accompanying diagrams were made by the method described above. The equipotential lines are shown only in the air surrounding the insulator and terminating upon its surface. No attempt was made to locate them within the body of the insulator. They

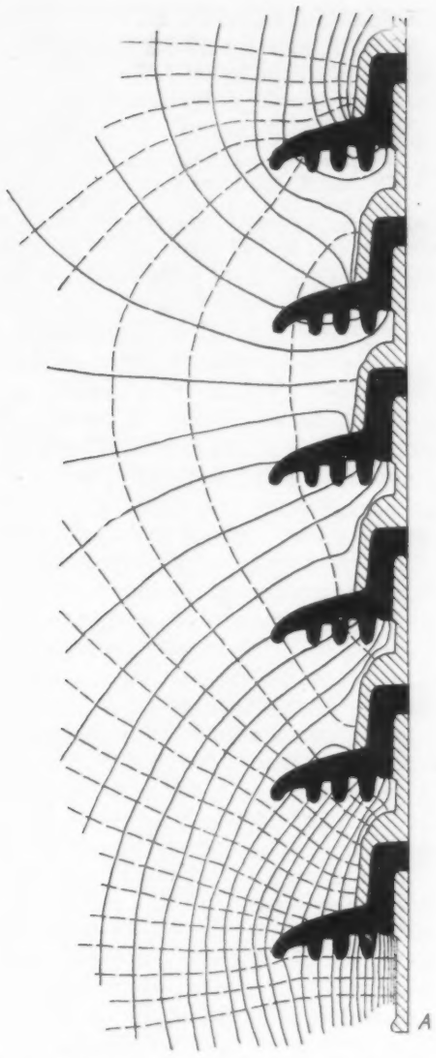

Fig. 17. Six-Unit String; Ground 2 string-lengths below A.

speak for themselves and little needs to be added to enable the reader to study and understand them for himself. They mean much or little according to one's own need and experience with high voltage line insulators. They express for all the voltage duty that the surfaces on an insulator and the atmosphere about it must sustain.

Figs. 5 to 13, inclusive, show the forms of various pin-type insulators, conductor mountings and their corresponding potential zones. Figs. 6 and 7 may be compared to note the change produced by rain that has rendered as yet only the top surface of the insulator conductive. The large change in the potential field produced by the substitution of a conducting base for a conducting pin is seen when Figs. 9 and 10 are compared. Changes in the field produced by the use of arcing rings are seen when Figs 9, 10 and 11 are compared. A comparative study of Figs. 5 and 13 is of particular interest. Link-type insulator potential fields are found in Figs. 14 to 17 inclusive. The corresponding changes in the fields due to the use of one, three or six units may be seen by comparing Figs. 14, 15 and 17. In the last, as stated earlier, the broken lines locate the tubes of electric force about the insulator. Some idea of the effect upon the potential field about a link insulator due to the use of arcing rings will be obtained by comparing Figs. 15 and 16.

APPREHENSION REGARDING THE NATIONAL ELECTRICAL SAFETY CODE.

BY R. J. McCLELLAND.

(This searching analysis of the shortcomings of the Code prepared by the U. S. Bureau of Standards is slightly condensed from the author's remarks at the Chicago conference on this subject, May 29, 1916. Mr. McClelland is chief engineer for the Electric Bond and Share Company and is an authority on problems attending public regulation of electric distribution lines.—The Editor.)

I am in sympathy with the aim of the Bureau of Standards in preparing this Code, i.e. to eliminate or discourage improper and unsafe construction and to bring about a somewhat greater degree of standardization than at present obtains. This aim, so far as it is realizable, will, I believe, result in great benefit not only to the public but to the electrical industry. I appreciate also the very full and fair opportunity which the Bureau has afforded the electrical utilities of expressing their views and of offering suggestions, although the wish might be expressed that the carefully prepared suggestions of the industry's representatives might have been accorded greater weight.

With the Safety Code in the form now presented, and with the understanding that it is to be urged for adoption as law, I cannot, however, do otherwise than view with grave apprehension its possible and indeed inevitable effects on the future growth of our industry and on the development of the regions which are more or less dependent upon electrical service.

If the Safety Code were to be administered by those who have framed it, the industry would not feel its present apprehensions. It could safely rely on the unwise features being eliminated as their effects became evident. But this Code is not to be administered by the Bureau of Standards, it will not and cannot be administered in the same broad and intelligent spirit in which it is framed. It will be administered mainly by men not in touch with or familiar with the needs of electric service and not in a position to understand the necessity for local modifications. The conclusion is inevitable that if the Code were formally adopted by state or municipal authorities, its administration would generally be inflexible, changes would be exceedingly difficult, even where sanctioned by the Bureau, and the Code would in the main become retroactive. While the Code is in the hands of the Bureau it is a growing thing, capable of any needed development or improvement. Once the Code has gone into the body of local laws, it has passed from the control of the Bureau. It is like a boulder started down a mountain side, once gone, its course and effects can no longer be guided or influenced.

A very unfortunate aspect of the situation, is that the Code contains at present certain features which are so impracticable that it is out of the question for the electrical utilities to observe them. The administrative authorities instead of altering these features would presumably merely allow them to go unenforced. The utilities would thus be forced into the position of breaking the law, a position they are exceedingly anxious to avoid.

The Code in its present form combines a detailed construction specification with a treatise on design. Now it seems to me impossible, and it has seemed impossible to all practical electrical men, to draw a minutely detailed specifications of national scope. It is inevitable that a detailed specification so drawn as to be adequate and reasonable for one section must be wholly unreasonable for another. If this Safety Code is to evolve into a Code generally fair and satisfactory, the first and most important step must be to strip it of much of its detail and to make it more a code of general results to be attained than of specific measures to be carried out.

The conditions over the country differ far too widely to permit of any generally applicable detailed code. The Safety Code at present covers one only of the points of difference, that of climate, and even this is covered merely by arbitrary boundaries drawn on a map. I may note in passing that this map places Dallas, Texas, in the same classification as regards sleet loading with the Atlantic Seaboard and the region adjoining the Great Lakes. The Safety Code ignores other points of difference between various parts of the country equally as important as those of climate, such as:

(a) Different standards of service;
(b) Different operating methods
(c) Difference in state of development of the region.

It is, or should be, obvious that the same standards and the same construction and operating methods cannot apply fairly both to regions where loads are large, distances are short and industries are well established, and on the other hand to regions where loads are small, distances are long and industries are struggling for a start.

It may be noted also that the Code appears to us to make rigorous provision not only against hazards which are evident and demonstrated, but against hazards which, while conceivable, have not been encountered in practice.

While not agreeing that a National Code can properly be a detailed specification, we have been, and are, desirous of co-operating in assuring that it at least be a reasonable and correct specification. From this viewpoint, there are numerous changes of specific features which should be made before the Code is issued, or at least before it is adopted by State Commissions. These changes are essential if, in some regions at least, actual disaster to the electrical industry and the public which it serves is to be avoided. It is, of course, not possible to enumerate these individual points now.

Many provisions are reasonable as applied to some regions but seriously restrictive as applied to others. Some, and some which are very important, are wholly wrong for any region. For instance, the strength requirements for line construction, taken in connection with the maintenance requirement, are more severe than in any specification I have ever seen issued. The initial strength requirements for lines would rule out a large amount of good modern construction. The combination of strength and maintenance requirements would, and I say it advisedly, not be met by two-thirds of the distribution lines now in service. The tendency to discourage joint construction between different companies and to require several parallel lines where one would serve is directly contrary to public policy. The placing of prohibitive requirements on the construction of light lines serving small loads will

be a public calamity. We have been endeavoring, ourselves and the industry generally, in the relatively undeveloped regions, to assist and accelerate the region's development. We are building lines which, even with the light construction now used are showing considerable deficit. To require that these lines be made more expensive is merely to require that we restrict or cease our efforts toward public development.

Another instance of wholly incorrect requirements is conductor sags. In the light of all of the experience since electric lines have been used, many of the sag requirements are absurd, being frequently double those now in use. Another instance is the prohibition of concentric wiring, probably one of the greatest advances in electrical distribution methods which recent years have produced. There are similar impractical and unwise requirements in other sections of the code.

It has been the hope of most of the electrical utilities that a Safety Code would be produced which the industry could welcome and whose sanction by state or municipal authorities they would not need to fear. This hope seems largely to have been proven vain. Unless important modifications are made in the proposed Code before it is issued, the utilities have no other course open, in justice not merely to themselves but to the present and future users of electrical energy, than at least to put forth every effort to procure radical revisions of certain features. The Code cannot be otherwise than a menace to the public good until these revisions are effected.

GILROY LIGHTING.

On Saturday, June 3, 1916, Gilroy, Cal., enthusiastically celebrated the installation of her new lighting system. The new system, which is the first of its kind on the Pacific Coast, consists of 35 4-ampere General Electric ornamental luminous arc lamps, and four pendant refractor luminous lamps, along the main street and extending onto the state highway. The lamps are the same as proposed and used by W. D'Arcy Ryan at the Panama-Pacific International Exposition and as will be used on Market street, San Francisco. Gilroy has the honor of being the first of California's smaller cities to adopt this very ornamental type of lighting system which is an ornament to the city section of the state highway and a telling advertisement to all visitors of the progressiveness of the city itself. The system has been installed on the standard smaller town lines, namely, staggered units approximately 150 ft. apart. The light is ample at any point on the street, and the system is a tremendous improvement over the old form of series incandescent pendant unit system. One of the particular features of this installation is that the entire system was installed at the expense of and as the property of the Coast Counties Gas & Electric Company, the local central station. The merchants and city were not asked to stand the installation costs, but the city signed a long time contract with the Coast Counties Company to take care of the upkeep, operation and initial investment, it being realized that this is the ideal arrangement for all concerned. The actual work of installing the system was done by the Gilroy Appliance Company, E. Douglas Hollenbeck, manager, and many compliments have been heard about the excellent work done and the appearance of the poles and lamps.

The Coast Counties Gas & Electric Company is reconstructing the entire lighting system inside Gilroy's city limits to conform to the state law of 1911. Enough reserve capacity in the series rectifier equipment is available to operate 15 more of either the ornamental or pendant refractor luminous lamps, and these will be added when conditions warrant. As soon as automobilists appreciate the big advantage of the present lighting, there will probably be a strong demand for the additional lamps further out on the highway.

COSTS OF ELECTRIC IRRIGATION PUMPING EQUIPMENT.

The following tables giving the capacity and prices of pumps and electric motors are prepared from data secured from various manufacturers and dealers and published in a bulletin on the Rogue River Valley Project as investigated by the U. S. Reclamation Service in co-operation with the State of Oregon. The prices in all cases are for material delivered f.o.b. Portland, being obtained in October, 1915, and representing approximately the net prices:

Cost of Electric Motors.
Three-Phase, Alternating Current, 60-Cycle Motors.

These prices hold for either 220 or 440-volt motors, and include pulley and sliding base.

Brake H.P.	Wgt. lbs.	Rev. per Min.	Price.
2	140	1,800	$ 57.10
3	180	1,800	64.70
5	340	1,200	105.10
7½	600	1,200	170.00
10	800	1,200	207.00
15	860	1,200	212.90
20	1,250	900	318.75
25	1,590	900	358.85
30	1,500	900	393.85

Single phase motors are from 30 to 60 per cent higher than above prices.

Cost of Electric Motor-Driven, Direct Connected Centrifugal Pump Units.
Three-Phase, Alternating Current, 60-Cycle Induction Motors.

These prices hold for 220 or 440-volt motors.

			Pump and Base				Motor		Complete Unit	
Pump Size, in.	Capacity, Gal. per Min.	Head Ft., Total.	Speed, Rev. per Min.	Weight, lbs.	Price.	Rated h.p. of Motor.	Weight, lbs.	Price.	Weight, lbs.	Price.
1	25	30	1,730	175	$ 70	1	80	$ 43	255	$113
1½	50	..	1,730	210	85	1½	83	47	293	132
2	100	..	1,730	225	100	2	145	53	370	153
2½	150	..	1,730	400	115	3	155	61	555	176
3	225	..	1,730	450	130	3	155	61	605	191
3½	300	..	1,730	500	145	5	225	70	725	215
4	400	..	1,730	550	160	5	225	70	775	230
5	700	..	1,130	800	250	10	755	200	1,555	450
6	900	..	1,130	1,000	270	10	755	200	1,755	470
7	1,200	..	1,130	1,300	300	15	900	235	2,200	535
8	1,600	..	1,300	1,500	350	20	1,125	275	2,625	625

Silicon steel is used in the construction of the cores of static transformers because the hysteresis loss is thereby lowered. Aluminum, phosphorus, nickel and tungsten have a similar effect, but silicon is the cheapest. For low induction its permeability is as great as that of any known iron alloy. The silicon content is usually between 4 and 4¼ per cent. The transformer cores are built up of thin sheets which are separately stamped to shape.

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Mapping Insulator Fields

Intensely interesting as the narrative of an explorer in a strange country is the account of Professor Harris J. Ryan's classic investigations into the field of electrostatic stress surrounding high tension insulators, as published elsewhere in this issue. Hitherto, little has been known of this hinterland of electrical science, inaccessible to commerce until its practical reality has been opened up by his discoveries. But now that the field has been mapped, great benefit is to be gained by the manufacturer and user of high tension insulators and high voltage bushings for oil switches and transformers.

A word of caution is necessary for the guidance of one who would follow the trail that has been blazed by Professor Ryan. The equi-potential lines which have been mapped by his student aides in following the lines of silence are merely the contour lines of the field. The gradient of strains is at right angles to these lines, just as the grades of a terrane are perpendicular to the contour lines of a map. Consequently in order to determine the tendency to puncture an insulation it is necessary to mentally visualize the stress gradients just as a traveller follows a map. The authors have done this in one instance to indicate the method. In this way it is possible to graphically determine the good and bad features of insulator design, and profit from this most commendable research work.

Profitable Electrical Contracting

One contractor, when approached on the subject of this editorial, like the farmer who saw a giraffe for the first time, exclaimed "there ain't no such animal." The fact of his statement is more nearly correct than is the grammar. Electrical contracting has a poorer financial rating than almost any line of business. The reasons are many, but all spring from the one taproot of ignorance of business principles.

Primarily the average electrical contractor is an expert workman, and secondarily a business man. That he has been so slow in learning business methods is largely the fault of the firms from whom he buys his supplies. Some electrical jobbers have been so shortsighted as not to recognize that their own success depends upon the success of their customers. This accusation seems harsh, but analysis will demonstrate its truth. Before the electrical business can expect to expand to its proper dimensions the foundation must be more securely laid. The business ability of the electrical contractor is the foundation of the electrical trade. This can be developed only by business instruction from the jobber and manufacturer.

True, there have been spasmodic efforts to teach better cost finding methods to the electrical contractor and dealer. Occasionally some one emphasizes the importance of taking account of the overhead and gives suggestions as to how to minimize it. Helpful hints are often given as to how to improve collections. But all these remedies only scratch the surface. They all ignore the reason most often named as a cause of business failures, or at least in naming it do not recognize its true import.

This fundamental obstacle to business success

is usually called "insufficient capital," which is only another name for insufficient frequency of capital turnover. It is not the amount of capital, but the frequency of turnover that determines profit. There is no cause that contributes more to negative profits, or Irish dividends, than infrequent turnover.

As a whole, there is perhaps no industry where the frequency of turnover is so low as in all branches of the electrical industry. This applies to the public utilities as well as to manufacturers, jobbers and dealers. The public utilities are constantly making extensions requiring new capital and the manufacturers are constntly developing new appliances and apparatus; the jobber and dealer sells a product for which there is little "come-back," excepting lamps and fuses. Electrical devices stay sold, and most business must be new business.

Yet the most common cause for infrequent turnover on the part of the dealer is too frequent overstocking. The jobber is perhaps more at fault here than the dealer, for the jobber at least knows the limitation of demand, whereas the dealer sees only the quantity discount. The dealer's best policy is not to overbuy and, in the long run, the jobber's best policy is not to oversell. Money tied up in a stock which does not move or which moves slowly is manifestly not available for swinging the rest of the business and so there appears to be insufficient capital, whereas actually there is only insufficient fluidity or turnover of capital.

Rapid turnover is the best way to counteract high overhead. Many electrical dealers hesitate to go into the regular retail districts with the consequent high rents. They have a dingy shop on some side street where shoppers seldom go. Yet other specialty shops seek the crowded thoroughfares and profit accordingly. So we venture the assertion that if the electrical dealer would investigate the immediate saleability of his stock as closely as he does its cost and the credit of the purchaser he would find that a high overhead is not necessarily an obstacle to profitable electrical selling.

Need for Engineering Preparedness

The Pacific Coast would be the most vulnerable part of the United States in case of war and probably the first to be invaded by any attacking force. An army of one hundred thousand men could be landed with little or no resistance at any one of a dozen points along the coast with less than twenty-four hours' notice to the inhabitants. The comparatively narrow strip between the Cascade-Sierra Nevada ranges and the sea could be quickly occupied and easily held. It contains everything necessary for the sustenance of an army and would be most attractive. The mountain barriers to the east would effectually protect it from recovery by any but the strongest force.

This is not the idle talk of an alarmist or of one who has ought to gain by the sale of munitions. It is merely a citation of obvious facts. The Pacific Coast was the last piece of continental territory to be acquired within the boundary of the United States proper and would be the first to be lost to a foe having an eye to its many natural advantages.

The time has come when we must be ready to repel possible invasion. And the man among all others who should and could take the leading part in this task is the engineer.

The engineer's training in construction, in handling and caring for large bodies of men and in meeting emergencies, eminently qualifies him as a leader in military organization. Modern warfare is largely a matter of applied engineering. Building defensive works, such as trenches, preparing military maps and acquiring military information, digging mines, transporting men and materials, operating field searchlights and electrifying barbed wire entanglements are duties with which engineers are thoroughly familiar. The regular army is lamentably weak in its engineer forces as is likewise the National Guard, there being but one company of the former and none of the latter west of the Rocky Mountains. With all our boasted engineering accomplishments there are not enough engineers of military age and having the requisite physical requirements in the entire country to furnish engineer officers for an army of a million men.

But engineering knowledge constitutes only one-tenth of what a military engineer must know. First he must know how to fight and then how to protect others who are fighting. How few engineers there are who even know the kind and number of men that they would have to gather together in an engineer company.

Fortunately these deficiencies are gradually becoming known. Here and there engineers are banding together to study the situation. In California an organization of an engineer corps is being perfected and the members taking up a two years' systematic course of study of the military art and military engineering under the tutelage of an officer of the regular army. Similar movements are to be launched in Oregon and Washington.

Unfortunately, however, many other engineers are withholding their support from such praiseworthy efforts so that they may see what action will be taken by the national engineering societies. These societies have been so occupied with the task of making an industrial inventory of material for the army and navy, that they have neglected taking up the problem of training the men who may have to use the material.

Under the provisions of the new army bill any civilian engineer can qualify as an engineer officer in the reserve list of the United States Army by passing an examination in military subjects. One purpose of the study course, as already mentioned, is to make it possible for engineers to pass these examinations.

Patriotism is the moving spirit of such engineering preparedness. Nothing but a prevalent policy of watchful waiting now stands in the way of its accomplishment. Meanwhile, until the Federal Government and the national engineering societies decide on some plan of action, it behooves Pacific Coast engineers to act on their own initiative, associate themselves with some one of the study classes, and be prepared for preparedness. Many years ago a learned philosopher wrote "While we stop to think we often miss an opportunity." The opportunity for engineering preparedness is knocking at the door of Pacific Coast engineers.

PERSONALS

Garnett Young, manager Telephone Electric Equipment Company, is at Seattle.

H. A. Bryte, electrical manufacturers' agent at San Francisco, is at the Yosemite Valley.

E. O. Shreve sales engineer with the General Electric Company, at San Francisco, is in the East.

C. C. Hillis, vice-president and general manager of the Electric Appliance Company, is at Los Angeles.

A. E. Peat, treasurer of the San Joaquin Light & Power Company at Fresno, is a recent visitor at San Francisco.

A. O. Austin, expert ceramist with the Ohio Brass Company, is visiting the Pacific Coast, now being at Los Angeles.

E. R. Davis, general manager of the Pacific Light & Power Company of Los Angeles, was a recent visitor at San Francisco.

B. M. Levy, manager of the Santa Rosa Division of the Great Western Power Company, was a recent visitor at San Francisco.

E. H. Priest, Pacific Coast manager of the Eugene Dietzgen Company, has left for a few weeks' vacation in the Yosemite Valley.

S. L. Nickolson, sales manager of the Westinghouse Electric & Manufacturing Company of Pittsburg, was a recent visitor at San Francisco.

A. L. Myers, electrical manufacturers' agent of San Francisco, has returned from an extended business trip throughout the Pacific Northwest.

A. J. Meyers, Pacific Coast manager of the Wagner Electric Manufacturing Company, left for a few weeks' business to the south.

Ira J. Wolf, Pacific Coast agent for the Pittsburg Specialties Company, has returned from a short business trip throughout the San Joaquin Valley.

W. L. Goodwin, vice-president and general sales manager of the Pacific States Electric Company, has returned to San Francisco from Los Angeles.

W. S. Heger has closed the San Francisco offices of the Busch-Sulzer Bros. Diesel Engine Company and is now looking after his private interests.

Will Davis, of the Pacific Research Laboratories of San Francisco, expects to make a trip through the San Joaquin Valley soon in the interests of the laboratories.

H. W. Whiteside, in charge of the munitions plant of the Westinghouse Company at Hartford, Connecticut, spent a few days the latter part of the week at San Francisco.

B. J. Klein, Pacific Coast representative of the Bristol Company of Waterbury, Conn., has returned to San Francisco from an extended business trip throughout the Northwest.

J. C. Manchester, manager of the Interstate Electric Novelty Company, has returned to San Francisco from a business trip throughout the Northwest, having visited Vancouver, Seattle, Portland, Spokane and Tacoma.

H. P. Royer, formerly connected with the Electric Railway & Manufacturers' Supply Company, has recently left that company and has joined the sales forces of the Marchant Adding Machine Company of San Francisco.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, was the speaker of the day and distributed medals to some of the old employes of the company, at a picnic given at Pinehurst June 10th.

C. L. Cory, professor of electrical and mechanical engineering at the University of California, is in the East where he will attend the annual meeting of the Society for the Promotion of Engineering Education and also the 25th re-union of his class at Cornell.

MEETING NOTICES.

The next meeting of the Electrical Supply Jobbers' Association of the Pacific Coast will be held at Del Monte, June 22, 23 and 24th. There will be an open meeting with the manufacturers on Saturday afternoon, June 24th.

Great Western Power Company N. E. L. A. Section.

The June meeting of the San Francisco Bay Section was held June 12th at the Hotel Oakland. A demonstration of high tension phenomena was given by A. S. Lindstrom of the Thorardson Transformer Company. The experiments covered a range of from 2 to 40,000 volts, and from a fraction of an ampere to 1500 amperes. Moving pictures of the laying of the third bay cable, were also shown, together with a paper by John A. Koontz, Jr., "Laying Power Cables Across San Francisco Bay."

Jovian Electric League of Los Angeles.

The spirit of patriotism permeated the atmosphere at the luncheon, Wednesday, June 7th, as plans for participation in the "Preparedness" parade on June 14th were discussed. The enthusiasm shown indicated that the league to a man, was heartily in favor of the policy of "Preparedness." The electrical division of the parade will be under the auspices of the league, and President Henry F. Holland was appointed marshal. John M. Morris is chairman of the arrangement committee. J. Harry Pieper, speaking for the power companies, announced their hearty co-operation and promised that every available man would be in line. A. E. Morphy, just back from the N. E. L. A. convention, in a short talk, gave some amusing side lights on the meeting and Mr. E. P. Smith, a financial expert from Chicago, also gave a short talk. The speaker of the day, Superior Judge Paul J. McCormick, delivered a stirring address on "Sparks at Random on the Subject of Patriotism." He said that the country is seeing a national awakening of the people to the realization of their responsibility as citizens; it is his belief that hyphenated-Americanism does not exist; that it is a hollow theory as no man can serve two masters or countries and the nation demands, and expects the loyalty, fealty and service of all who enjoy the protection of the constitution, laws and liberties of the country. Jas. F. Rogan, local manager of the Edison Storage Battery Company, was chairman of the day.

San Francisco Electrical Development and Jovian League.

With President E. M. Cutting again at the helm and with E. A. Wilcox as chairman of the day, the June 7th League Luncheon developed much enthusiasm for the rejuvenation and other activities under way. The speaker of the day was Mr. Willis Booth of Los Angeles, president of the Hot Point Electric Company and incidentally candidate for U. S. senator from California. His address amply demonstrated his thorough understanding of Pacific Coast needs. He stated that Frederick the Great's famous prophesy that a big country could never be a successful republic had been disproved largely because of electricity's influence. Electricity is likewise binding nations more closely, and it becomes necessary for this country to take a leading part in the world's affairs. He traced the four great epochs in American history,—the making of the republic under Washington, the era of expansion with the Louisiana purchase, the unification of the nation under Lincoln and the freedom from isolation under McKinley. As regards Pacific Coast affairs, he referred to the need for adequate water power legislation and suggested that Jovian leagues get behind the Shields and Myers bills. He spoke of the great industrial development to which the Coast is destined. He called attention to the need for relief in the oil fields, the necessity for a merchant marine and harbor improvements, and detailed facts regarding the Japanese menace, especially as regards the control of Lower California. He urged that the Alaska situation be treated in a business way. After showing the need for preparedness, he closed his address with an inspiring picture of the opportunity to build the highest type of civilization on the Pacific Coast.

SAN FRANCISCO-OAKLAND JOINT REJUVENATION.

Twenty-nine electrical men were initiated into the mysteries of the Jovian Order at a rejuvenation in Trestle Glen, Oakland, on the night of January 10th, under the joint auspices of Tribunes Orrick and Wilcox of San Francisco and Woodward and Hill of Oakland. The novel feature of an outdoor affair with spectacular lighting effects contributed largely to the success of the affair. The ceremonies were held under a great group of trees by the weird light of lanterns and red fire. A flaming forge marked Vulcans work place deep in the forest and a roaring bonfire took off the chill of the night air and formed a gathering place for the exchange of experiences after the serious work of the evening was over.

The excellent rendition of the ritual also added to the effectiveness of the rejuvenation. Mr. Geo. Gray as Pluto, striking particular terror to the hearts of the neophytes. The several parts were taken as follows:

Jupiter, A. E. Drendell
Neptune, E. M. Cutting
Vulcan, A. H. Halloran
Pluto, Geo. Gray
Mars, E. A. Wilcox
Hercules, W. C. Wurfel
Apollo, A. E. Rowe
Mercury, H. E. Bittman

Imps, Frank Mills, Harold Wolff, Wm. Tardiff.

The new members were welcomed and individually introduced by T. E. Collins, past tribune, during the course of an alfresco supper served after the initiation. Some excellent entertainment had been provided and brief addresses were also made by F. H. Legget, E. M. Cutting, H. R. Noack and others.

Everybody present voted it a most successful affair.

The following candidates were rejuvenated:

E. A. Bullis, Federal Sign System (Electric.)
Paul C. Butte, Butte Electric & Engineering Co.
F. W. Buzzell, Buzzell Electric Works.
Carl C. Caven, Western Electric Co.
Frank B. Ellis, Ellis Elec. & Cons. Co.
Robert R. Ebel, California-Oregon Power Co.
Lee B. Gilpen, Piedmont Electric Co.
R. M. Gilson, Pacific States Electric Co., Oakland.
I. K. Gutfeld, Electric Appliance Co.
W. P. L'Hommedien, Westinghouse Elec. & Mfg. Co.
R. D. Kyser, Great Western Power Co.
C. B. Kenney, Ne Page, McKenny Co.
A. S. Lindstrom, Thordarson Transformer Co.
C. W. Malone, California-Oregon Power Co.
J. C. Manchester, Interstate Elec. Novelty Co.
W. C. Martinez, Western Electric Co.
C. J. Newbery, F. E. Newbery Co.
R. B. Peterson, Telephone-Electric Equipment Co.
W. C. Sage, General Electric Co.
T. W. Simpson, Federal Sign System (Electric.)
J. T. Stewart, Electric Railway & Mfrs. Supply Co.
E. B. Strong, Jr., Journal of Electricity, Power and Gas.
M. H. Seid, Ichelheimer Bros. Co.
Edgar Sproul, United Electric & Gas Co.
H. C. Stoddard, California-Oregon Power Co.
C. H. Thane, Pierson, Roeding & Co.
P. W. Todt, Western Electric Co.
Don Trego, Trego, Electric Co.
Kurt Wolff, Interstate Electric Novelty Co.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The railroad commission has authorized the Santa Barbara Gas & Electric Company to issue $1,000,000 face value 5 per cent first mortgage bonds, at not less than 91, under a deed of trust to the Los Angeles Trust & Savings Bank. Of the bonds, $210,000 will mature serially at the rate of $10,000 a year, from 1920 to 1940. From the proceeds of sale $884,625 is to be used to retire company's outstanding issue of $824,500 of bonds at 105, and $25,375 to reimburse company for expenditure made from income.

The Central California Gas Company, which serves gas at Visalia, Tulare, Exeter, Lindsay, Strathmore and Porterville, has applied to the commission for authority to issue $19,000 face value first mortgage 6 per cent sinking fund gold bonds, to deliver $12,000 worth to the Los Angeles Trust and Savings Bank, trustee, to meet sinking fund obligations, to sell $7000 bonds at 90 per cent, to issue $67,000 6 per cent cumulative preferred stock to be sold for not less than 80, and to issue $21,500 common capital stock at par.

NEWS OF IDAHO PUBLIC SERVICE COMMISSION.

After due investigation the commission has dismissed the complaint of Local Union No. 291, I. B. E. W. that the Electric Investment Company has violated the commission's rules for certain work at Boise.

NEWS OF ARIZONA CORPORATION COMMISSION.

With regard to the informal complaint brought by C. R. Osburn on behalf of the Board of Control of Arizona, alleging that the maximum electric lighting demand of the capitol building and of the state asylum for the insane as fixed by the Pacific Gas & Electric Company, is excessive, the commission ordered that hereafter bills be based on a maximum demand as shown by tests.

The Mountain States Telephone & Telegraph Company and Prescott Gas & Electric Company have been notified to apply to and secure permission from the commission to transfer pole lines now jointly owned, before said transfer shall be consummated.

To correct discriminatory rates and to permit the Mountain States Telephone & Telegraph Company to earn a fair rate of return the commission has approved the company's standard Class "A" rates for Tucson upon the completion of structural work now in progress.

The Globe Light & Power Company has been given authority to purchase and install additional equipment at a cost of $12,354 as follows:

Nordberg Mfg. Co., Milwaukee, Wis.:	
15 by 24 Uniflow Engine; contract	$3,950.00
Estimate to put in engine	615.00
General Electric Co.:	
150 kw. Generator, 200 r.p.m; contract	1,957.00
Estimated to put in generator	239.00
Fred M. Prescott:	
Condenser and condenser pumps	1,500.00
Estimated put in condenser	120.00
Cooling tower	600.00
Foundation for generator, engine and condenser	500.00
Extension of building	1,000.00
Piping and labor	500.00
Oil separator and steam traps	250.00
	$11,231.00
Ten per cent contingent	1,123.00
	$12,354.00

The application of the Tucson Gas, Electric Light & Power Company for an order authorizing the deferring of the 1916 depreciation charges, or an order exempting the company from setting aside any depreciation reserve prior to January 1, 1917, has been denied.

TRADE NOTES.

NePage, McKenny Company, Portland, have been awarded a contract to install all the electric lighting features for the Columbia Beach Amusement Company, which is spending about $30,000 in erecting a modern amusement resort at Columbia Beach, on the Columbia River, near Portland.

The Reliable Electric Company has received the wiring contract for the San Francisco Dairy Company at No. 1553 Turk street, San Francisco.

The Electric Novelty Sign Company of 165 Eddy street, San Francisco, has taken a contract for an electric spelling flasher with letters 14 ft. high to read "Folger's Golden Gate Coffee," erected on this firm's roof facing San Francisco Bay.

Crocker-Wheeler Company have removed their San Francisco salesrooms from 618 Mission street to 87 New Montgomery street, a ground floor location where a large stock of motors can be displayed to good advantage. A large stock is to be carried for the convenience of local buyers.

John A. Turner, city clerk, Prince George, B. C., will receive tenders up to noon, July 8th, for power plant equipment. Specifications and forms of tender may be had at the office of the consulting engineers, DuCane, Dutcher & Company, Rogers Building, Vancouver, B. C., or at the office of the city clerk, Prince George.

The Northwestern Electric Company of Portland has closed one of the largest orders for electric ranges yet reported in the Northwest, in a commission to install 54 "Hughes" ranges in the new Imperial Arms Apartment, under construction for R. F. Wassell. Mr. Wassell also installed Hughes ranges throughout in his Tudor Arms apartment building last year and the results were so satisfactory that he determined on the same equipment for his newest apartment.

NEWS NOTES

FINANCIAL.

SAN FRANCISCO, CAL.—The Mt. Whitney Power & Electric Company of Visalia has been purchased from John Hays Hammond of New York City by H. E. Huntington, president of the Pacific Light & Power Corporation of Los Angeles, whose Big Creek transmission line runs through the Mt. Whitney territory. The two systems will be tied together.

ILLUMINATION.

POMEROY, WASH.—A movement is on foot for the installation of cluster lights on Main street, which would cost about $1800.

HAYWARD, CAL.—The Pacific Gas & Electric Company is arranging to extend its gas main to San Lorenzo via Laurel avenue and Cherry station.

LOS ANGELES, CAL.—The city council has ordered proceedings started for the ornamental lighting of Washington street from Main to Vermont.

BLYTHE, CAL.—It is stated that the establishment of an electric lighting plant is being considered in Blythe as soon as the town is incorporated.

CLAREMONT, CAL.—The Southern California Edison Company has been granted a franchise to lay and operate a gas distributing system in this city.

RIDDLE, ORE.—Formal acceptance of the franchise for establishing in Riddle an electric light and power business has been filed with the city recorder by A. E. Brais, and actual construction work will begin shortly.

SANTA MONICA, CAL.—The city commissioners have instructed the city attorney to draft an ordinance calling an election to submit to the voters a proposition of a bond issue of $350,000 to construct or acquire a municipal gas plant.

TULARE, CAL.—Circular letters and maps outlining a plan for the installation of an electrolier system in Tulare are being sent to property owners in the business district and it is expected the system will be installed in the near future.

LOS ANGELES, CAL.—Petitions for improved lighting of Monte Vista Park have been presented to the board of supervisors and the clerk has been directed to notify the petitioner that the only method of securing lights is by the formation of a lighting district.

HOLLYWOOD, CAL.—Actual work on the construction of a municipal lighting system and distributing system for aqueduct power will begin by July 15th. The city council will advertise for bids about November 1st for lighting that section of the city that cannot be covered by the municipal system.

SAUSALITO, CAL.—The town trustees have awarded a franchise to supply gas, to J. A. Fish, representing local capitalists interested in incorporating a Sausalito gas company. The franchise provides that work on the plant must begin within 90 days and that the rate to be charged shall never be higher than $1.10 per 1000 cubic feet.

BERKELEY, CAL.—The following bids were received by the Regents of the University of California for furnishing and installing lighting fixtures in the library building on the campus, propositions A and B respectively:

E. A. Mantell	$22,704	$17,546
Thos. A. Day Co.	17,446	11,653
Ickelheimer Bros.	23,000	14,200
Maxwell Hardware Co.	24,400	14,350
Bradshaw Electric Company	26,963	16,900
Spott Bros.	29,933	15,181
Leo. J. Meybery	23,800	15,900
Roberts Manufacturing Company	21,323	14,941

TRANSMISSION.

BAKER CITY, ORE.—A line has been surveyed by the Idaho-Oregon Power Company for the transmission of electric power to the Iron Dyke and Homestead mines at Homestead, and construction work will start immediately.

SPOKANE, WASH.—Wm. Shannon, manager of the Four Timbers Mining Company in the Coeur d'Alene has closed a contract with the Washington Water Power Company for the extension of the power line to the mine.

TACOMA, WASH.—The board of commissioners of Pierce county has set June 23 as the date for hearing the application of the Puget Sound Traction, Light & Power Company for a franchise to construct a power line over the public roads of the county.

TACOMA, WASH.—Application has been made to the county commissioners by the Tacoma Railway & Power Company for a franchise to erect a power line along Lincoln avenue on the tide flats. The commissioners will give the franchise if the wires do not conflict with telephone wires.

LOS ANGELES, CAL.—The city council has instructed the city attorney to start proceedings to acquire by condemnation a right of way over certain property for the purpose of constructing a power transmission line, together with telephone lines from a point in Inyo county to a point in Los Angeles county.

SAN FRANCISCO, CAL.—Three towers of the San Francisco & Sierra Power Company near South San Francisco were blown up by miscreants with dynamite on the morning of June 11th. No interruption to the United Railroads service was experienced, as the auxiliary steam plant was immediately started. Company officials are at a loss to explain the motive of the deed.

TRANSPORTATION.

OAKLAND, CAL.—The San Francisco and Oakland Traction Company is laying tracks on Grand avenue to connect the Grand avenue line with the Key Route track now ending at Broadway under the Key Route Hotel.

SANTA ANA, CAL.—The Pacific Electric and the city trustees have reached an agreement, by which the Railway Company will get the two franchises which it has been seeking. The company will build a curve at the northwest corner of Fourth and Main streets, a switch off North Main street on to the Southern Pacific tracks at Santa Clara avenue, pave strip on East Fourth street east of the Santa Fe, put tracks into good shape, and put heavier rails on the streets, some of them immediately and others later on.

PORTERVILLE, CAL.—With the visit of officials of the Southern Pacific Railroad, together with Traffic Manager Pontius of the Pacific Electric Company, it became known that the new extensions of the Porterville Northeastern will be operated electrically. It has become known that the extensions to be constructed south from Adobe station to the newly-opened orchards in the Deer Creek district, will be constructed by the Pacific Electric Company, and will be later leased to the Southern Pacific for operation.

TELEPHONE AND TELEGRAPH.

GILROY, CAL.—Bids for the new telephone building to cost $7,000 have been advertised for.

BURLINGAME, CAL.—Plans for a new central telephone station to be built near Floribunda avenue have been completed.

EL PASO, TEX.—A radio station is to be constructed at Fort Bliss for communication with all the border signal service camps.

IRRIGATION.

SACRAMENTO, CAL.—The Carmichael Colony Irrigation District will vote June 24 on a bond issue of $90,000 for a pumping plant on the American River, ditches, pipes, etc.

NORTH YAKIMA, WASH.—Reclamation Service engineers have established camp at intake of Mabton syphon feeder canal and are making final surveys for irrigation works for watering 4000 acres. Construction work starts within 30 days.

SALINAS, CAL.—A bond issue to finance a reclamation district from South Lake to Heinz Lake, thence to Mud Lake through Carr's Lake and down the ditch to Tembladera, a total distance of 17.7 miles, is contemplated. Lateral canals to cost $15,000, and a main canal to cost $50,000, are proposed.

ANDERSON, CAL.—The directors of the Anderson-Cottonwood Irrigation district have rejected all bids for main gates, side gates and drops. Two bids on the Churn Creek siphon were considered, but neither was accepted. One bid is for $38,000, the other for $37,500. No action was taken on bids for the dam. The lowest bid is $46,000. To date contracts have been let aggregating $236,000.

LAFAYETTE, CAL.—Preliminary steps have been taken looking toward the formation of a Wright irrigation district of 35,000 acres and including the present Woodbridge irrigation system. It is planned to bond the district for $300,000, the bonds to run 40 years. The territory is located west of Lodi and south of Woodbridge. It is proposed to construct a storage dam in the foothills east of Lockeford. Over 22,000 acres have already been signed up.

VISALIA, CAL.—Legal representatives of more than a score of irrigation companies have filed formal protests in the courts against the proposal of the Lindsay-Strathmore Irrigation District officials to drive a series of deep wells along the banks of the Kaweah and St. Johns rivers for the purpose of developing water sufficient to irrigate 15,000 acres of citrus land south of Exeter. The protest is also filed against R. E. Hyde, owner of the property on which it is proposed to sink the wells. The irrigation district officials declare there is no connection between the wells and the amount of flood water.

NORTH YAKIMA, WASH.—Orders to immediately prepare final plans and specifications for the construction of a diversion dam across the Yakima River at the intake of the Wapato canal and the reconstruction of the present distributing system and an extension of this system to cover the 120,000 acres included in the Wapato project on the Yakima Indian reservation have been received by L. M. Holt, superintendent of irrigation, from the Indian office at Washington.

OAKDALE, CAL.—The irrigation board has accepted the Cape Horn tunnel built by James Willison and allowed him the final estimates on the contract, which totaled $60,263. The board has also ordered the extension of the Campbell lateral, near the Lone Tree section, to supply water to the Steltzner, Campbell and other lands, a total of about 800 acres. The board voted to install a pipe line to provide water for land owned by Bellefontaine Bros., Rodden Bros. and Schadlich & Endicott. About 1650 ft. will be needed and the cost is estimated at $1200.

SAN FRANCISCO, CAL.—Applications for permission to appropriate water have been filed with the State Water Commission by A. D. Schindler of San Francisco who has applied for permission to appropriate 2000 second feet of the waters of the South Fork of the Kings River, 2000 second feet of the main Kern River and 1000 second feet of the Tule and Kaweah rivers, a total of 5000 second feet, for the Tulare irrigation district. E. H. Dodge of San Francisco makes application, as the forerunner of a corporation which he says is to be organized, for the purpose of appropriating 500 cubic feet per second of the waters of Lee Vining creek, in Mono county, for the irrigation of desert lands.

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The letter and number before each name are used in the classified page following

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A-2 Atchison, Topeka & Santa Fe Railway Co.....
673 Market St., San Francisco; 1218 Broadway, Oakland.

B-1 Baker-Joslyn Company.....
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles.

B-2 Benjamin Electric Manufacturing Co..... 5
590 Howard St., San Francisco.

B-5 Bridgeport Brass Co..... 4
(See Pierson, Roeding & Co.)

C-1 Century Electric Co..... 12
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 Crocker-Wheeler Co.....
Crossley Bldg., 618 Mission St., San Francisco; 228 Central Avenue, Los Angeles.

C-4 Cutler-Hammer Manufacturing Co.....
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-4 Davis Slate & Manufacturing Co..... 3
Chicago, Ill.

D-2 Dearborn Drug and Chemical Works..... 11
355 East Second St., Los Angeles; 301 Front St., San Francisco.

E-7 Economy Fuse & Mfg. Co.....
Kinzie and Orleans Sts., Chicago.

E-1 Edison Lamp Works of General Electric Co.....
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 Edison Storage Battery Supply Co..... 11
441 Golden Gate Ave., San Francisco.

E-3 Electric Agencies Co.....
247 Minna Street, San Francisco; Central Building, Los Angeles.

E-6 Electric Novelty Works.....
533 Mission St., San Francisco.

E-4 Electric Storage Battery Co.....
743 Rialto Bldg., San Francisco.

E-5 Electric, Railway & Manufacturing Supply Co..... 11
34 Second St., San Francisco.

F-1 Fairbanks, Morse & Co.....
Los Angeles; Portland; 651 Mission St., San Francisco; Seattle; Spokane.

F-3 Federal Sign System (Electric).....
618 Mission St., San Francisco.

G-1 General Electric Co..... 10
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

G-1 General Vehicle Co.....
1117 Van Ness Ave., San Francisco; 331 Wall St., Los Angeles; British Columbia Electric Ry., Ltd., Vancouver, B. C.

H-1 Habirshaw Electric Cable Co., The..... 2
(See Western Electric Company.)

H-2 Hemingray Glass Co..... 4
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco.

H-3 Haller-Cunningham Electric Co..... 12
428 Market St., San Francisco.

H-5 Hunt, Mirk & Co.....
141 Second St., San Francisco.

H-7 Hurley Machine Co.....
New York and Chicago. (See Pacific States Electric Co.

I-2 Illinois Electric Co.....
261-263 So. Los Angeles St., Los Angeles.

I-3 Interstate Electric Novelty Co.....
111 New Montgomery St., San Francisco.

L-1 Leahy Manufacturing Co.....
Eighth and Alameda St., Los Angeles.

L-2 Locke Insulator Manufacturing Co..... 4
(See Pierson, Roeding & Co.)

M-2 McGlauflin Manufacturing Co.....
Sunnyvale, Cal.

M-4 Morse Chain Company.....
Monadnock Bldg., San Francisco.

M-3 Moore & Co., Charles C..... 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 Nason & Co., R. N.....
151 Potrero Ave., San Francisco.

N-6 National Carbon Company..... 7
Cleveland, Ohio.

N-2 National Conduit & Cable Co., The.....
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.

N-3 National Lamp Works of G. E. Co..... 3
(All Jobbers.)

N-4 New York Insulated Wire Co.....
629 Howard St., San Francisco.

N-5 Northwestern Pacific Railroad..... 3
808 Phelan Bldg., San Francisco.

O-1 Okonite Co. (The)..... 12
(All Jobbers.)

P-1 Pacific Electric Manufacturing Co.....
80 Tehama St., San Francisco.

P-2 Pacific States Electric Co..... 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle.

P-4 Pelton Water Wheel Co..... 4
2219 Harrison St., San Francisco.

P-5 Pierson, Roeding & Co..... 4
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-6 Pittsburgh Electric Specialties Company.....
202 Aronson Bldg., San Francisco.

P-7 Pittsburgh Piping & Equipment Co..... 12
Monadnock Bldg., San Francisco.

S-1 Schaw-Batcher Company, Pipe Works, The.....
211 J St., Sacramento; 356 Market St., San Francisco.

S-4 Southern Pacific Co..... 4
Flood Bldg., San Francisco.

S-5 Sprague Electric Works..... 3
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 Standard Underground Cable Co..... 4
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Yeon Bldg., Portland; Central Bldg., Seattle, Wash.

T-1 Thomas & Co., R.....
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives.

T-2 Tubular Woven Fabric Company.....
Pawtucket, R. I.

U-1 Union Sheet Metal Works.....
575 Howard St., San Francisco.

W-1 Wagner Electric Manufacturing Company.....
St. Louis, Mo.

W-2 Western Electric Co.....
Eighth and Santee Sts., Los Angeles; 1900 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 901 First Ave., Seattle; 45 North Fifth St., Portland, Ore.

W-3 Ward-Leonard Electric Co..... 7
Mt. Vernon, New York.

W-4 Westinghouse Electric and Manufacturing Co..... 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second St., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-5 Westinghouse Machine Co.....
141 Second St., San Francisco.

W-6 Westinghouse Lamp Co.....
(See Westinghouse Electric & Manufacturing Co.)

W-8 Western Pipe & Steel Co.....
444 Market St., San Francisco; 1758 North Broadway, Los Angeles.